GRAPHICAL ANALYSIS OF LENGTH FREQUENCY DISTRIBUTION OF *CHAMPSOCEPHALUS GUNNARI* LONNBERG (CHANNICHTHYIDAE) FROM SOUTH GEORGIA (1)

by

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ABSTRACT. – Four distinct size groups were present in the length frequency distributions of *Champsocephalus gunnari* collected off South Georgia during seven periods in the course of the Antarctic expeditions 1975/76 and 1977/78 of the Federal Republic of Germany. On the basis of preliminary otolith readings it can be assumed that each size group represents one age group (0, 1, 2, 3). This indicates that *C. gunnari* grow faster in their first two years and reach sexual maturity at least one year earlier described by Olsen (1955).

RÉSUMÉ. – Quatre groupes de taille distincts ont été mis en évidence dans la distribution des fréquences de longueur des *Champsocephalus gunnari* capturés au large de la Géorgie du Sud pendant sept périodes différentes au cours des Expéditions antarctiques 1975/76 et 1977/78 de la République Fédérale d'Allemagne. Sur la base de la détermination de l'âge au moyen des otolithes, on peut dire que chaque groupe de taille correspond à un groupe d'âge (0, 1, 2, 3). On en conclut que *C. gunnari* grandit plus rapidement au cours des deux premières années et atteint la maturité sexuelle au moins un an plus tôt que ne l'avait décrit Olsen (1955).

INTRODUCTION

In recent years there have been several published accounts of age determination of Antarctic nototheniids (Olsen 1954, Wohlschlag 1961, Everson 1970, Hureau 1970, Scherbich 1975, Frolkina 1977, Linkowski & Rembiszewski 1978, Freytag 1979) whereas information on age and growth of channichthyids is much less, being restricted to the limited study of Olsen (1955) and a few general remarks in Rembiszewski *et al.* (1978).

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Channichthyids lacks scales, the structure which have been mainly used for age determination in nototheniids. Their bones are weakly calcified and growth zones on the small and more or less spherical otoliths are difficult to interprete. In order to gain some insight into channichthyid growth rates polymodal length frequency distributions were analysed graphically and the distinct size groups that were identified were referred to age groups (Peterson's method). It is known that this method is generally only successful for young specimens. This study was therefore limited to fish of up to 32 cm. Results must be regarded as preliminary because only a few comparative otolith readings are currently available. The results may, however, serve as a useful basis of discussion.

MATERIALS AND METHODS

Samples were taken from bottom and Krill trawl (1 X) hauls onboard FRV «*Walther Herwig*», FMS «*Weser*» and «*Julius Fock*» during seven periods in the course of the Antarctic Expeditions 1975/76 and 1977/78 of the Federal Republic of Germany. Total length (cm below) and sex of each individual investigated were recorded. No sexual dimorphism in growth rate was detectable and therefore data for both sexes were combined for the analysis. Graphical analysis of length distribution curves was carried out by Cassie's (1954) method using probability paper.

RESULTS

27-30 December 1975

Size distribution of catches (n = 889) was characterized by five clearly visible peaks (fig. 1). Truncation and irregularities in the graph of the smallest specimens

Tab. 1. – Mean length per length group (age) of *Champsocephalus gunnari* off South Georgia derived from graphical analysis of length frequency distributions

Length group (age group)	27-30.12.75		22.3.76		11-15.4.76		9-10.11.77		30-31.1.78		9.2.78		28.3-2.4.78		2-3.4.78 spawning grounds	
	$\bar{l}$	S_D	$\bar{l}$	S_D	$\bar{l}$	S_D	$\bar{l}$	S_D	$\bar{l}$	S_D	$\bar{l}$	S_D	$\bar{l}$	S_D	$\bar{l}$	S_D
1 (AG 0)	5.6	1.55	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2 (AG 1)	15.4	1.00	–	–	19.8	1.05	14.0	1.0	15.5	0.60	–	–	18.2	1.45	–	–
3 (AG 2)	22.6	1.65	24.9	1.65	–	–	22.8	1.15	24.5	1.70	–	–	25.5	1.90	–	–
4 (AG 3)	26.9	1.70	–	–	–	–	26.0	1.30	27.5	1.85	27.6	1.70	–	–	28.0	1.70

are thought to be related to duration of spawning period, different hatching times of the larvae at different locations (West of Annenkov Island and off Bird Island), influence of net selectivity of the krill trawl. Smallest specimens were therefore considered to form one peak. In fig. 2 data were plotted as cumulative percentages. The points form four distinct points of inflexion of 22.1, 41.7, 73.7 and 99.9 per cent, i.e. four distinct length groups (Proportions 22.1, 19.6, 32.0, 26.2 %) are present in the material. Their mean lengths (1) are 5.6, 15.4, 22.6 and 26.9 cm respectively (tab. 1).

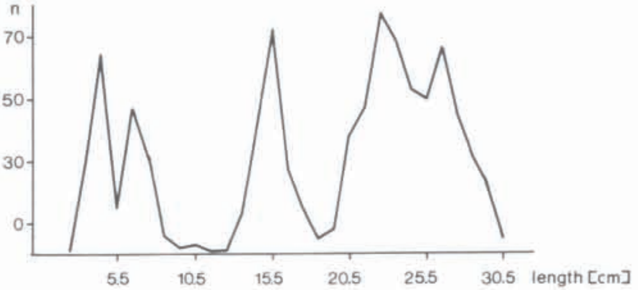

fig. 1. – Length frequency distribution of *C. gunnari* ; 27-30 December 1975.

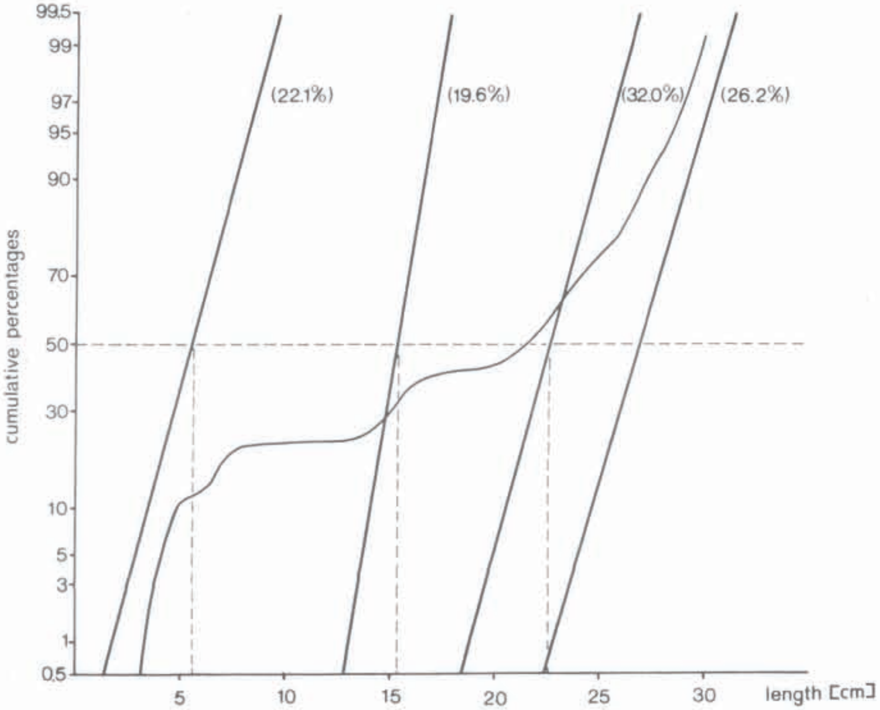

fig. 2. – Cumulative percentage length distribution of *C. gunnari* ; 27-30 December 1975.

22 March 1976

One clearly defined peak is dominant in the length frequency distribution of the samples (n = 442, fig. 3). All points plotted as cumulative percentage were found to lie approximately in a straight line indicating that only one length group was present. Its mean length was 24.9 cm (tab. 1).

11-15 April 1976

Two peaks were present in the size distribution curves of the material (n = 1038, fig. 3). The cumulative percentages indicated that there is only one distinct point of inflexion at 15.2 per cent. (fig. 4). The mean length of the smaller size group responsible for this was 19.8 cm (tabl. 1). The peak on the right part of the curve was probably compounded by more than two size distributions overlapping to a high degree and these were impossible to separate.

9/10 November 1977

The length frequency distribution of catches (n = 383) was characterized by 2 peaks (fig. 5). Truncation of the left part of the graph was obviously caused by net selectivity of the bottom trawl. Cumulative percentages form three points of inflexion at 42.8, 54.3 and 93.1 per cent, indicating that three different size groups (proportions 42.8, 11.5, 38.8 %) are present in the material (fig. 6). Their mean lengths are 14.0, 22.8, 26.0 cm respectively (tab. 1).

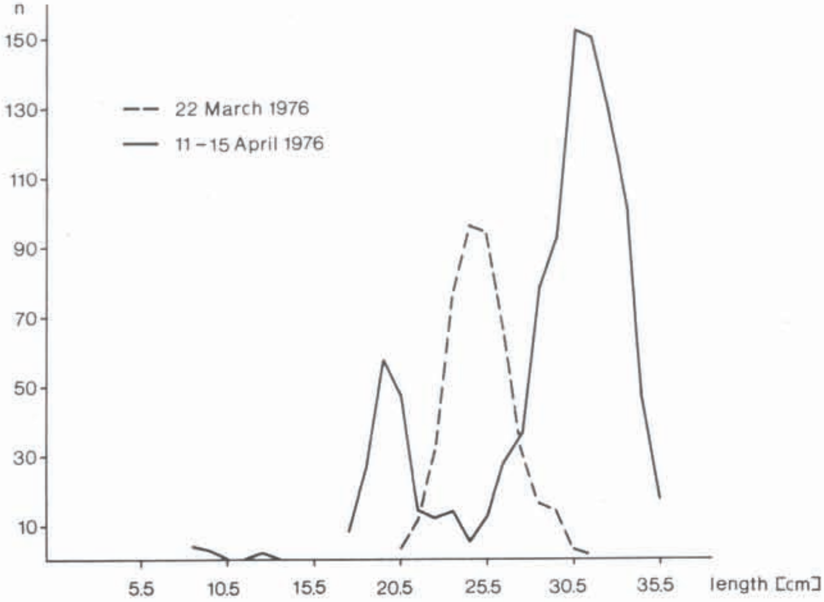

fig. 3. – Length frequency distribution of *C. gunnari* ; 22 March, 11-15 April 1976.

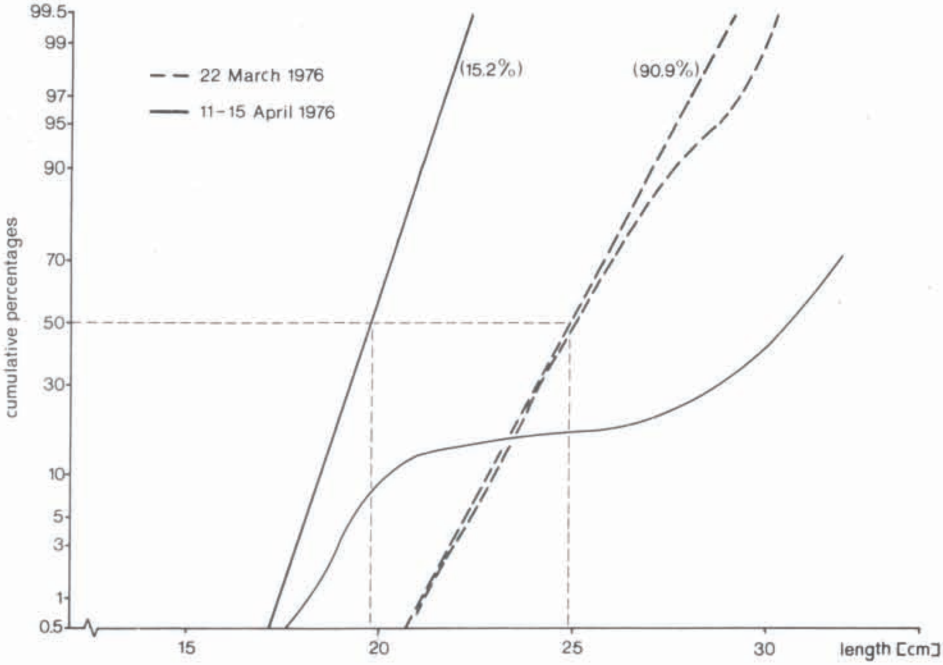

fig. 4. – Cumulative percentage length distribution of *C. gunnari* ; 22 March, 11-15 April.

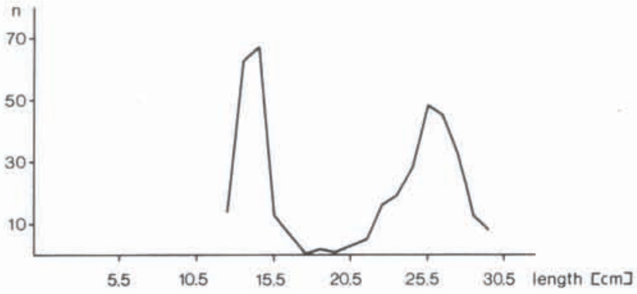

fig. 5. – Length frequency distribution of *C. gunnari* ; 9/10 November 1977.

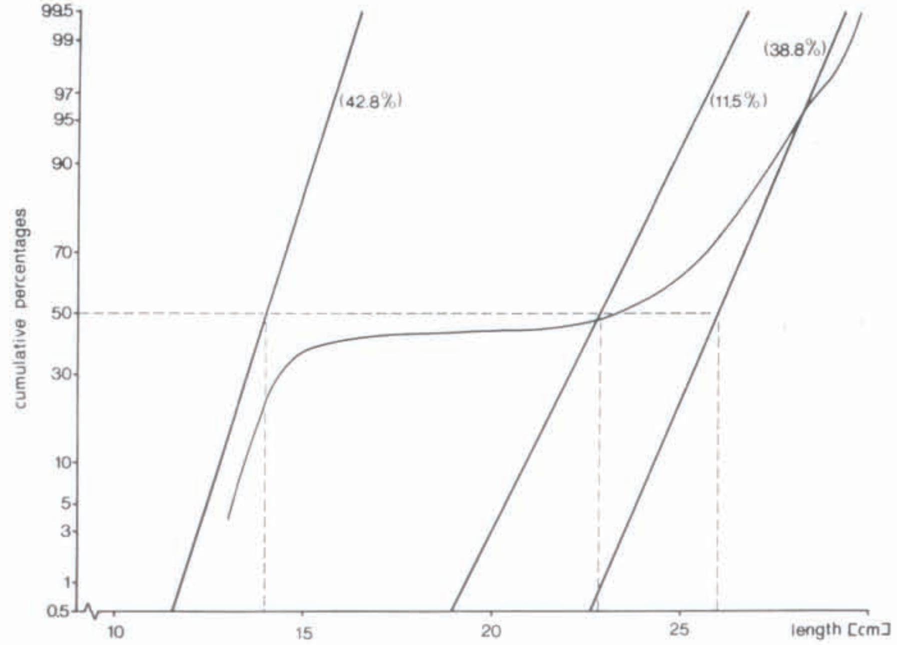

fig. 6. – Cumulative percentage length distribution of *C. gunnari* ; 9/10 November 1977.

30/31 January 1978

The length frequency distribution of catches (n = 482) shows three clearly visible peaks (fig. 7). Cumulative percentages form three distinct points of inflexion at 9.8, 42.7 and 98.7 per cent (fig. 8), indicating that three different size groups (proportions 9.8, 32.9, 56.1 %) are present in the samples. Their mean lengths were 15.5., 24.5 and 27.5 cm respectively (tabl. 1).

9 February 1978

The length frequency distribution of samples (n = 221) was unimodal (fig. 7). Cumulative percentages (fig. 8) lie approximately in a straight line, i.e. only one size group (proportion 90.9 %) was present in the material. Its mean length was 27.6 cm (tab. 1).

28 March - 3 April 1978

The size distribution of the fish (n = 195) has two distinct peaks (fig. 9) although the cumulative percentages form at least three points of inflexion at 29.3, 81.7 and 95 per cent (fig. 10), indicating that three different size groups were present in the material. As the third group was only weakly represented, the analysis was limited to the first two groups. Their mean lengths were 18.2 and 25.5 cm (tabl. 1).

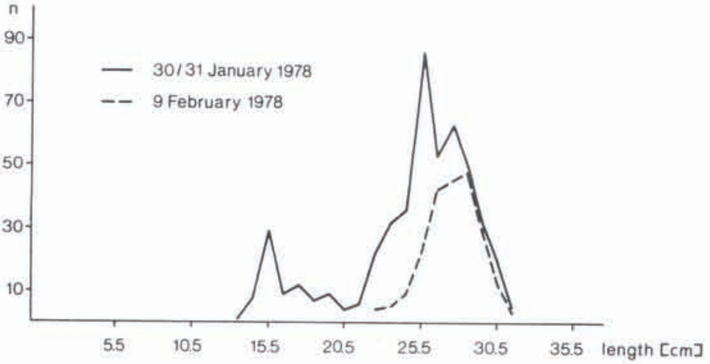

fig. 7. – Length frequency distribution of *C. gunnari* ; 30/31 January, 9 February 1978.

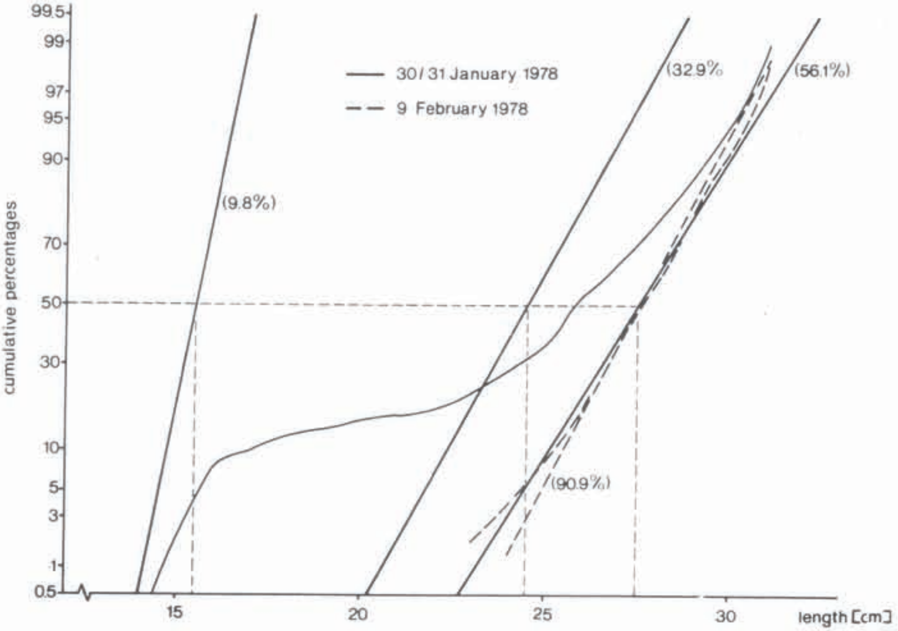

fig. 8. – Cumulative percentage length distribution of *C. gunnari* ; 30/31 January, 9 February 1978.

2/3 April 1978. spawning grounds

The size distribution curve of fish sampled from prespawning concentrations in Cumberland West Bay, Fortuna Bay and Royal Bay (n = 705) differed from the preceding distribution in that at these localities there was only one clearly defined peak (fig. 9). Cumulative percentages (fig. 10) lie approximately in a straight line indicating that only one size group (proportion 100 %) was present in the material. Its mean length was 23.0 cm (tab. 1).

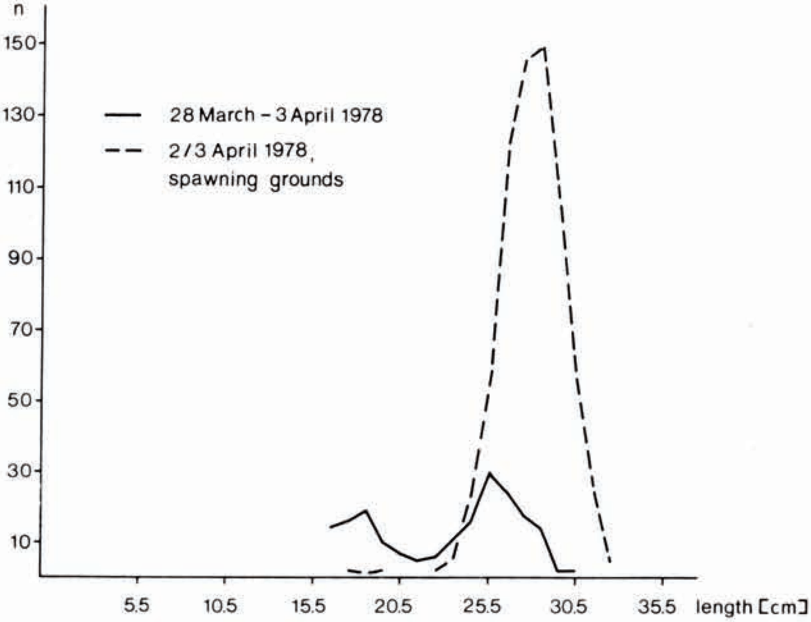

fig. 9. – Length frequency distribution of *C. gunnari* ; 28 March - 3 April 1978.

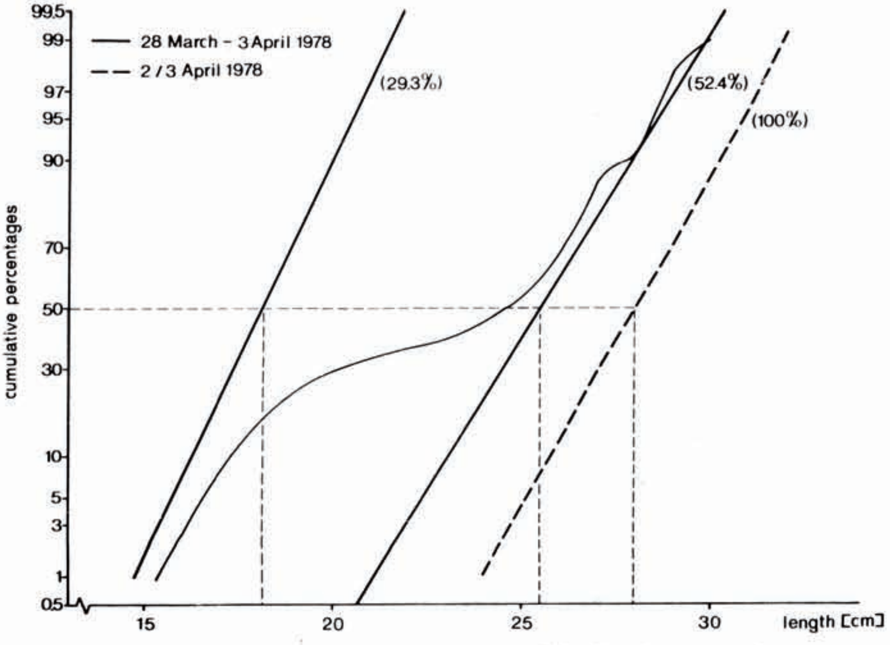

fig. 10. – Cumulative percentage length distribution of *C. gunnari* ; 28 March - 3 April 1978.

DISCUSSION

On the basis of the 'complete' size frequency distribution of material from 27-30 December 1975 (fig. 1) the other size groups observed at different sampling periods were arranged according to their mean lengths and times of observation (tab. 1).

Table 1 clearly demonstrated the similarity of mean lengths at similar times in both seasons. Differences within a time series (e.g. 1975/76) can be explained by growth.

Differences between the two seasons are probably due to natural variation. Information on the early life history and growth in *C. gunnari* is scarce. Spawning takes place from April to May/June (Olsen 1955, Permitin, 1973). Incubation of the large and yolky eggs probably lasts the whole winter as has been described for *Harpagifer bispinis* (Daniels 1978)) and *Notothenia neglecta* (White pers. comm.). Hatching probably occurs in October/November. As neither eggs nor early larval stages were found in December 1975 (Seibert 1977) hatching probably occurs in October/November. The otoliths of the smallest specimens (left peak in fig. 1) show no formation of annuli although a considerable number of microincrements are discernible and are probably caused by unknown short term cycles. This indicates that those specimens belong to age group O.

Champsocephalus gunnari reach sexual maturity when their length is greater than 18 cm and the bulk reach sexual maturity at 21-26 cm length. Preliminary otolith readings in specimens of 20-30 cm size (length groups 3 and 4 in tab. 1) show a good agreement with age groups 2 and 3.

It can therefore be assumed that each length (1, 2, 3, 4, tab. 1) represents a distinct age group (0, 1, 2, 3). If this assumption is correct it can be concluded that *C.gunnari* grow faster in their first two years and reach sexual maturity at least one year earlier than described by Olsen (1955).

Acknowledgement

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